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10 (54) Title of the Invention: Crucible Replacing Device of Vacuum Evaporation Device

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Specification

1. Title of the Invention

25 Crucible Replacing Device of Vacuum Evaporation Device

2. Scope of Claim

30 A crucible replacing device of a vacuum evaporation device comprising a vacuum chamber 1 in which a crucible 2 filled with an evaporation material and a heating device 3 for melting the evaporation material by heating are provided, wherein a plurality of crucibles 2 are provided, and a table 4 which can be freely rotated and moved up and down and sequentially houses the plurality of crucibles in the heating device 3, is provided.

3. Detailed Description of the Invention

The present invention relates to a crucible replacing device of a vacuum evaporation device, which is used for forming a thin film over a semiconductor substrate or the like.

Conventionally, a crucible filled with an evaporation material and a heating device for melting the evaporation material by heating the crucible, have been generally provided in a vacuum chamber of an evaporation device. In order to prevent a constituent of a crucible used in the evaporation device and an impurity substance contained in the crucible from vaporizing and mixing in a substrate and the like, in recent years, when Al, an Al alloy, or the like is evaporated, a crucible formed of pyrolytic boron nitride (PBN) has been used. However, when the crucible formed of PBN is subjected to high temperature, the crucible is cracked in a relatively short amount of time, and therefore, the crucible formed of PBN has a disadvantage that an evaporation operation cannot be performed continuously for a long time.

An object of the present invention is to overcome the above mentioned disadvantage. A crucible replacing device of a vacuum evaporation device of the present invention includes a vacuum chamber 1 in which a crucible 2 filled with an evaporation material and a heating device 3 for melting the evaporation material by heating the crucible are provided, wherein a plurality of crucibles 2 are provided, and a table 4 which can be freely rotated and moved up and down and sequentially houses the plurality of crucibles in the heating device 3, is provided.

FIG. 1 shows an example of the crucible replacing device of the vacuum evaporation device. In FIG. 1, the heating device 3 is of an induction heating type. Double axes 5a and 5b which pass through the inside and outside of the vacuum chamber 1, are provided at the side of the heating device 3. A table 4 formed of a quartz plate having housing holes 6 which houses the crucibles 2 by supporting the crucibles with flanges 2a, is attached to the outer axis 5a. Also, a circular dust-proof plate 7 is attached to the inner axis 5a. An edge portion of the outer axis 5a is connected to a pulse motor 9 through a rotating shaft bearing 8, whereas an edge portion of the inner axis 5b is connected to a cylinder 11 through a joint 10. Further, a base of the pulse motor 9 which is led by a leading lever 12, is attached to the joint 10 so that when the inner axis 5a is pushed with the cylinder 11, the outer axis 5a and the motor 9 are also pushed together with the inner axis. Reference numeral 13 is a vacuum seal

for maintaining an airtight condition so as to inhibit air from intruding into the vacuum device due to insertion of the double axes 5. Reference numeral 14 is a crucible degasification heater provided at the side of the heating device 3; and 15, a cutout portion provided in the dust-proof plate 7 over the heating device 3. As shown in FIG. 3, tubular shields 17 may be provided over the table 4 through support mediums 16 and the crucibles 2 may be housed in the respective tubular shields. In this case, an opening 18 is formed at the bottom of the heating device 3 such that the support mediums 16 and the shields 17 can enter in the heating device. The table 4 is connected to the motor 9 and the cylinder 11 by a single axis 19.

An operation of the device of the present invention shown in FIG. 1 and FIG. 2 will be described below. The crucibles 2 filled with an evaporation material are housed in the respective housing holes 6 of the table 4. When one of the crucibles 2 is housed in the heating device 3 and the crucible is heated, the melted evaporation material is vaporized in the vacuum chamber 1 through the cutout portion 15 of the dust-proof plate 7, and then is adhered to a substrate or the like provided over the vacuum chamber to have a thin film form. When the evaporation material in the crucible 2 housed in the heating device 3, is mostly vaporized, the cylinder 11 connected to the inner axis 5b is extended, and the table 4 and the dust-proof plate 7 are lifted by the cylinder. Subsequently, the pulse motor 9 connected to the outer axis 5a is rotated, and then the table 4 is rotated such that the next crucible 2 is lifted over the heating device 3. Thereafter, the cylinder 11 is shortened and then the next crucible 2 is housed in the heating device 3 so that the evaporation material is continuously vaporized over the substrate or the like. During the intermittent rotation of the table 4, each crucible 2 is housed in the crucible degasification heater 14 once, and each crucible is subjected to a degasification treatment.

According to the present invention, since the plurality of crucibles 2 are provided in the table 4 and each crucible 2 is housed in the heating device 3 in turn by moving up and down and rotating the table 4, when one crucible 2 is broken or the evaporation material run out, the replacement of the crucible 2 can expeditiously be carried out. Even in the case of using crucibles formed of PBN, which are easily broken, the present invention has effects, for example, an evaporation operation can be efficiently performed for a long time.

4. Brief Description of Drawings

FIG. 1 is a top plan view of one example of a device of the present invention;

FIG. 2 is a cross sectional view along a line II – II of FIG. 1; and

FIG. 3 is a cross sectional view of a modified example of FIG. 2.

1: vacuum chamber, 2: crucible, 3: heating device, 4: table

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審査請求 未請求 (全 頁)

⑮ 考案の名称 真空蒸着装置に於けるるつば交換装置

⑯ 実 願 昭58-123298

⑰ 出 願 昭58(1983)8月10日

⑱ 考 案 者 土 谷 高 陽 藤沢市亀井野891-2

⑲ 出 願 人 日本真空技術株式会社 茅ヶ崎市萩園2500番地

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明 細 書

1. 考案の名称

真空蒸着装置に於けるるつぼ交換装置

2. 実用新案登録請求の範囲

真空室(1)内に蒸発材料を収容したるつぼ(2)とこれを加熱して該材料を溶解させる加熱装置(3)とを設ける式のものに於て、複数個のるつぼ(2)を備え且つこれを順次加熱装置(3)に収容する旋回並びに昇降自在のテーブル(4)を設けて成る真空蒸着装置に於けるるつぼ交換装置。

3. 考案の詳細な説明

本考案は半導体基板等に薄膜を形成するに使用される真空蒸着装置のるつぼ交換装置に関する。

従来この種蒸着装置は真空室内に蒸発材料を収容したるつぼとこれを加熱して該材料を溶解させる加熱装置とを設けるを一般とするが、これに使用されるるつぼはるつぼの組成分や含有不純物が蒸発して基板等に混入することを防止すべく近時 A1、A1 合金材料等の蒸着にはパイ



ロチックボロンナイトライド (PBN) により製作したるつぼが用いられるようになった。而してこのPBN製のつぼは高温にさらされると比較的短時間で割れ始めるので長時間連続して蒸着作業を行なえない不都合がある。

本考案はこうした不都合を解消することをその目的としたもので、真空室(1)内に蒸発材料を収容したるつぼ(2)とこれを加熱して該材料を溶解させる加熱装置(3)とを設ける式のものに於て複数個のるつぼ(2)を備え且つこれを順次加熱装置(3)に収容する旋回並びに昇降自在のテーブル(4)を設けて成る。

第1図はその1例を示すもので、これに於ては加熱装置(3)を誘導加熱式のもので構成し、その側方に真空室(1)を内外に挿通して2重軸(5)を設け、その外軸(5a)にるつぼ(2)をそのフランジ(2a)で支えて収容する収容孔(6)を形成した石英板製のテーブル(4)を取付けると共にその中軸(5b)に円形の防塵板(7)を取付けした。該外軸(5a)の端部を回転軸受(8)を介してパルスモ

ータ(9)に連結すると共に該中軸(5b)の端部を継手(10)を介してシリンダ(11)に連結し、さらに該継手(10)に案内杆(12)で案内されたモータ(9)のベースを取付け、該中軸(5a)がシリンダ(11)で押されたとき外軸(5a)及びモータ(9)もこれと共に押されるようにした。(13)は2重軸(5)の挿通に伴う気密を維持する真空シール、(14)は加熱装置(3)の側方に設けたるつぼ脱ガスヒータ、(15)は加熱装置(3)の上方の防塵板(7)に形成した切欠部である。該テーブル(4)に第3図示のように受台(16)を介して筒状のシールド(17)を設け、その内部に夫々るつぼ(2)を収容する構成とすることも可能であり、この場合加熱装置(3)の下方には受台(16)及びシールド(17)が出没し得る開孔(18)を形成し、該テーブル(4)は単軸(19)によりモータ(9)及びシリンダ(11)に連結される。

本考案装置の作動を第1図及び第2図示のものにつき説明するに、テーブル(4)の各収容孔(6)に蒸発材料を入れたるつぼ(2)を収め、その1つを加熱装置(3)に収めて加熱すると溶解した蒸発



材料が防塵板(7)の切欠部(15)を介して真空室(1)内に蒸発し、上方に設けられた基板等に薄膜状に付着する。加熱装置(3)のるつぼ(2)内の蒸発材料が大部分蒸発すると中軸(5b)に連結したシリンダ(11)が伸びてテーブル(4)及び防塵板(7)を持ち上げられ続いて外軸(5a)に連結したパルスモータ(9)が回転して次のるつぼ(2)が加熱装置(3)上に来るようにテーブル(4)が回転する。このあと該シリンダ(11)が縮み該次のるつぼ(2)を加熱装置(3)内に收容して蒸発材料の蒸発が続けられる。テーブル(4)の間歇的な回転の途中でるつぼ(2)はるつぼ脱ガスヒータ(14)に一旦収められ、脱ガス処理が施される。

このように本考案によるときはテーブル(4)に複数個のるつぼ(2)を設け、これの昇降旋回を行なつて交代で加熱装置(3)にるつぼ(2)を收容するようにしたのでるつぼ(2)の破損或は蒸発材料の減少時に迅速にるつぼ(2)の交換を行なえ、こわれ易いPBNのるつぼを使用した場合であつても長時間の蒸着作業を能率良く行なえる等の効

果がある。

4. 図面の簡単な説明

第 1 図は本考案装置の 1 例の平面図、第 2 図はそのⅠ－Ⅰ線截断側面図、第 3 図はその変形例の截断側面図である。

- | | |
|-------------|-------------|
| (1) …… 真空室 | (2) …… るつぼ |
| (3) …… 加熱装置 | (4) …… テーブル |

実用新案登録出願人

日本真空技術株式会社

代 理 人

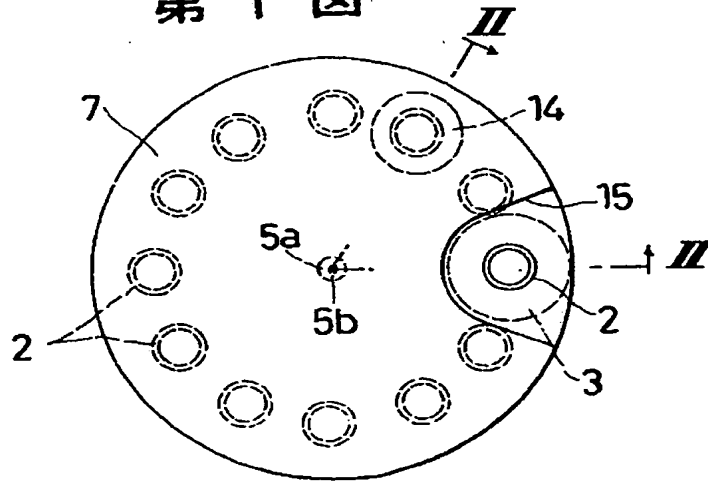
北 村 欣 一

外 2 名

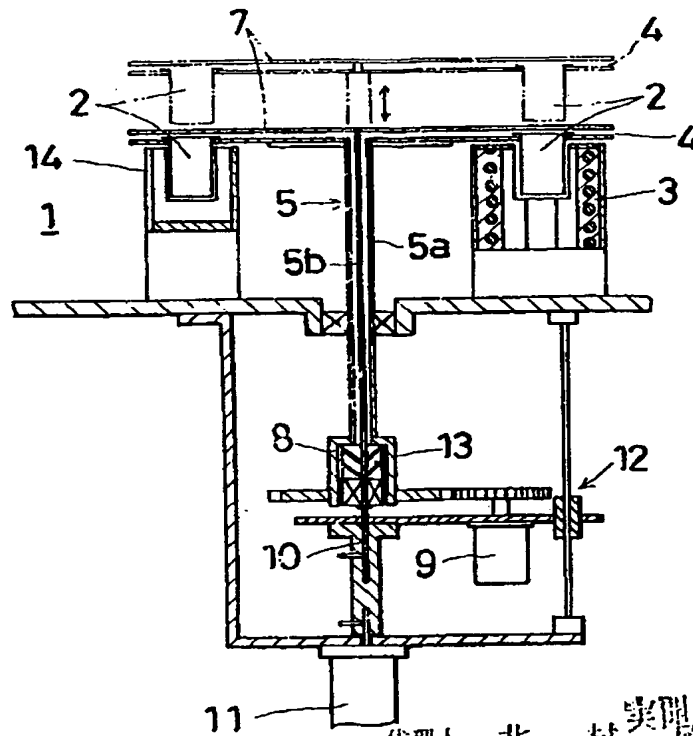




第 1 図



第 2 図

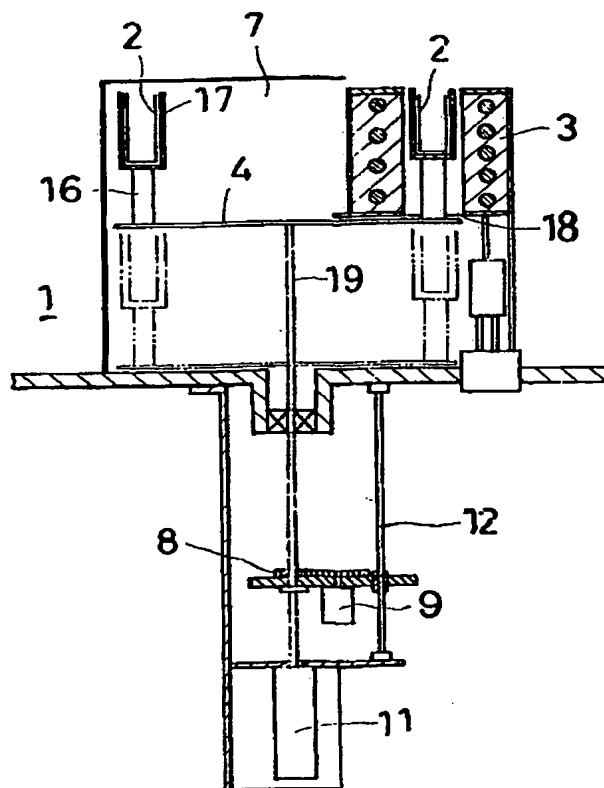


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11 代理人 北 村 欣 一
他 2 名

第3図

第 3 図



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代理人 北 村 欣 一
他 2 名